



White Sands Complex (WSC) Very High Frequency-1 (VHF) Upgrade Operational Readiness Review (ORR)

Melissa Blizzard

May 30, 2012

BASELINE 07/02/12



Agenda

- **Welcome/Review Board**
- **History**
- **Fault Isolation**
- **System Evaluation**
- **System Enhancements**
- **Procurement**
- **Installation**
- **VHF-1 Upgrade Components**
- **VHF-1/2 Equipment Shelter White Sands Ground Terminal (WSGT)**
- **VHF-1 Equipment at Extended TDRS Ground Terminal (ETGT) (rear)**
- **VHF-1 Equipment at ETGT (front)**
- **Reconfigured VHF-1/2 Rack at WSGT (Ground Control Equipment [GCE] room)**
- **Antenna Components**
- **VHF-1 Antenna at ETGT**
- **System Testing**
- **Elevation Positioner Failure/Repair**
- **System Re-test**
- **Discrepancy Reports (DR)**
- **Maintenance**
- **Spare Parts**
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- **Remaining Work**
- **Project Schedule**
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- **Summary**
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- **CoFR Signature Sheet**
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Review Board

- **Carolyn P. Dent, Chairperson, GSFC, Code 301, Systems Review Office**
- **Scott A. Greatorex, GSFC, Code 450.1, Chief, Networks Integration Management Office**
- **John J. Hudiburg, GSFC, Code 599, 450 Senior Technical Authority**
- **Joseph M. Aquino, JSC-DD13, Manager, Space Communications Integration Office**
- **Marco M. Midon, GSFC, Code 453, Ground Network Project**
- **Donald W. Shinnars, GSFC, Code 452, Space Network Project**
- **Michael E. Yettaw, DFRC Range Technical Monitor, Western Aeronautical Test Range**
- **Jeffrey F. Volosin, GSFC, Code 450.0, Deputy Associate Director for ESC**
- **James A. Bangerter, GSFC, Code 450.1, Human Spaceflight Network Director**



History

- **June 1997:**
 - VHF-1 station installed at WSC to augment MIR communication coverage
 - Icom receivers were modified to support 143.625 MHz (not supported by Icom)
- **December 1997:**
 - VHF-2 was added to support Soyuz
 - Two single yagi antennas were added to the VHF-1 quad yagi structure
 - One of the single yagi antennas was for balance only (not electrically connected)
- **December 2000:**
 - The VHF-1 tower was reconfigured to support dual quad yagi VHF-2 antennas
 - The single yagi VHF-2 antenna did not provide sufficient link margin to communicate with the Soyuz
 - There were insufficient funds to erect a second tower



History (cont'd)

- **September 2001:**
 - **VHF system was reconfigured to a quad yagi antenna center configuration with a single yagi antenna on each side**
 - **The dual quad antenna structure was unable to tolerate the high wind loads**
 - **New configuration was VHF-2 center quad yagi antenna with VHF-1 single yagi**
 - **VHF-2 transmit was upgraded from 150 watt Power Amplifier (PA) to a 350 watt PA**
- **April 2004:**
 - **Noise problems being experienced throughout the Network**
 - **Upgraded receivers and transmitter to Government Furnished Equipment (GFE) Modular Receiver/Transmitter (MRT)**



History (cont'd)

- **April 2004:**
 - **Emergency Communications Verification supports at WSC continue to be intermittently noisy**
 - **Testing identified high ground noise environment**
 - **Spacecraft link margin not met below 20 degrees**
 - **Requirements changed to restrict the scheduling of WSC VHF-1 Emergency Voice Verification supports to passes with a minimum of 20 degrees elevation**



History (cont'd)

- In 2010 Johnson Space Center (JSC) started reporting problems during supports:

DATE	MAXIMUM ELEVATION	JSC AUDIO QUALITY		COMMENTS
		UPLINK	DOWNLINK	
03/22/10	32.2 Degrees	3/3	3/3	Excessive Static
05/26/10	69.8 Degrees	5/5	5/5	Good Pass
07/14/10	29 Degrees	N/A	N/A	Antenna did not move in EL. CDS #59214 opened. Pass un-useable
09/14/10	51.3 Degrees	5/5	4/4	Downlink Noisy. JSC requested investigation; CDS #258962 was opened
11/16/10	39.5 Degrees	5/5	5/5	WSC rated this pass 4/5 on the Uplink. JSC reported intermittent loss of uplink audio before antenna masking time; CDS #259114 was opened
01/14/11	37 Degrees	5/5	5/2	Excessive static on downlink; CDS #259244 was opened. JSC reported pass unacceptable
02/04/11	80 Degrees	5/5	3/3	Antenna stopped movement in Elevation at 47 degrees; CDS #259310 was opened
03/24/11	49.3 Degrees	1/1	1/1	Excessive noise. Opened CDS #259441
07/06/11	33.2 Degrees	5/4	5/4	LOS at 9.0 deg EL due to terrain. D/L was readable but scratchy. Eng test pass
08/31/11	31.1 Degrees	5/5	5/5	WSC was scratchy with some echo, but good com with ISS using system 1
09/30/11	29 Degrees	5/5	5/5	Good check out



Fault Isolation

- **On 10/15/10 the WSC VHF system status was changed to yellow pending an investigation into the cause of the noisy downlink**
 - **The “B” equipment string was made prime in an attempt to isolate the problem**
- **The Yellow Ground Network Status (GNSTAT) message was reissued on 01/02/11 – no specific equipment problems had been identified**
 - **Troubleshooting revealed that the noise was being experienced on both the “A” and “B” strings of equipment**
 - **WSC recommended a filter be installed prior to the input to the pre-amp**
 - **New filter received on 01/06/11 (shipped from Goddard Space Flight Center [GSFC]) test bed. There was no improvement in signal quality**
 - **WSC also requested a new PA which was ordered**



System Evaluation

- **On 01/10/11 - 01/14/11 GSFC Engineers performed an on site evaluation of the WSC system. Recommendations included;**
 - **Separate the VHF-1 and VHF-2 systems**
 - **Install new VHF-1 tower and antenna, and relocate associated hardware. Implemented 02/17/12**
 - **VHF-2 to remain in current location**
 - **Remote system equipment indications (output power, receiver signal strength) to the OPS floor. Implemented 02/21/12**
 - **A camera and monitor to allow the Operator observation of antenna movement during a support. Will be implemented during EC-TO011-02, the VHF-2 reconfiguration Equipment Change (EC)**



System Enhancements

- **Prior to the upgrade some enhancements were made in an attempt to improve the signal quality**
 - **Installed a new PA in VHF-1 System 1 on 03/18/11**
 - **There was no appreciable improvement in the noise level**
 - **Directional Couplers Installed (08/2011)**
 - **The transmit and receive equipment was relocated in the racks (09/2011) to separate VHF-1 and VHF-2 equipment**
 - **Re-cabling of Radio Frequency (RF) equipment racks (09/2011)**
 - **Replaced all RF cabling with cables specified for VHF frequencies**
 - **Support taken after the re-cabling was significantly improved**
- **Pre-amps (1 for VHF-1, 1 for VHF-2 and a spare) were ordered in 08/2011 and installed during the system upgrade in 02/2012**



Procurement

- **Statement of Work (SOW) approved on 07/26/11 officially starting the upgrade work. Request for Proposal's were initiated:**
 - **08/16/11: Received no response from RJ Communications and a no-bid from Tower and Communications. This lack of response was unexpected and caused a delay to the project**
 - **WSC was requested to pursue quotes from additional vendors**
 - **Decision was made to order the materials directly from M² and modify the SOW to indicate installation of the GFE materials only**
 - **08/26/11: SOW was updated to reflect procurement of installation services only**
 - **M² was selected to provide the complete VHF antenna and tower hardware package**
 - **Advance Tower Services was selected to erect the tower and affix the antenna**



Procurement (cont'd)

- **Once the selection of the vendors was in place there were several events that lead to further delays in the start of the actual work**
 - **Selection of the Pad**
 - **Engineers being pulled off for higher priority work**
 - **Soyuz Launch / freeze periods**



Installation

- **Assembly of the tower and antenna by Advance Tower Services was started on 01/09/12 and completed on 01/15/12**
- **Minor issues were encountered prior to, during and post-assembly of the antenna and tower**
 - **Prior to erecting the tower the epoxy (Simpson SET-XP) for securing the tower mounting bolts was found to not be within local temperature curing specifications (M² shipped an approved replacement epoxy (Simpson AT) to the station)**
 - **T-Brace rods were 3 inches too short (due to a vendor error). M² was contacted and shipped replacements**
 - **Combiner assembly was missing from hardware shipment (due to vendor oversight) – later shipped from M²**
 - **During antenna checkout azimuth drive began blowing fuses**
 - **Faulty azimuth thrust bearings were replaced (Advance Tower Services supplied replacement bearings)**



Installation (cont'd)

- **Removal and integration of the VHF-1 equipment from the VHF equipment shed to ETGT was performed on 01/31/12**
 - Legacy Equipment installed in ETGT 02/01/12 - 02/08/12
- **Racks modified in WSGT GCE room 02/09/12 - 02/17/12**
- **Additional Improvements were made during re-location**
 - Installed upgraded downlink pre-amps
 - Improved interface to Mission Operations Voice Enhancement (MOVE)
 - Significantly cleaner installation (see before/after photos)



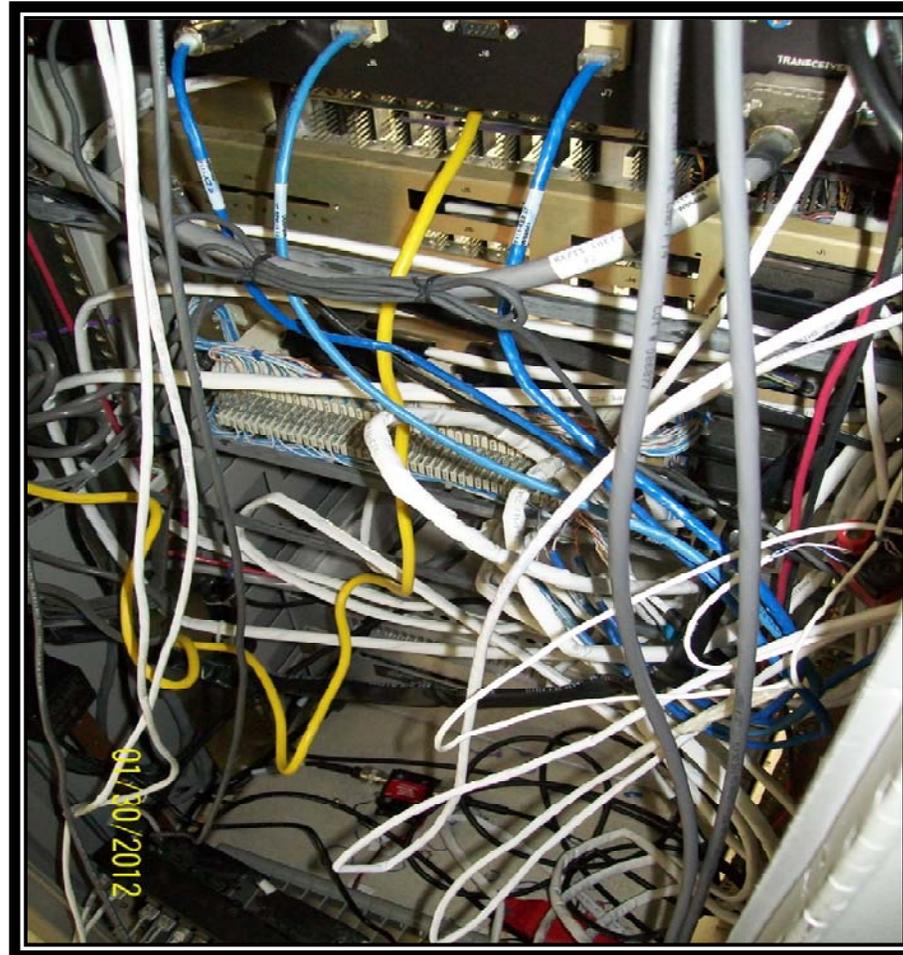
VHF-1 Upgrade Components

Subsystem	Equipment	Key Specifications
	H-Frame & T-Brace Kit	4 Bay Array
	Azimuth Motor Assembly	Specified by Vendor for 4 Bay Array
	Elevation Motor Assembly	Specified by Vendor for 4 Bay Array
Antenna and RF Components	Tower Assembly	30 foot Tower
	Limit Switch Kit	Specified by Vendor for 4 Bay Array
	Safety Climb Kit	For 30 foot Tower
	14 Element YAGI Antenna	135 – 144 MHz
	4 Port Power Divider	135 – 144.5 MHz
Voice System 08/31/11	MOVE Keypad	
	Voice Trunking Gateway	Voice over T1
Misc	Video Cameras & Monitor	



VHF-1/2 Equipment Shelter (WSGT)

Before





VHF-1 Equipment at ETGT (rear)

After





VHF-1 Equipment at ETGT (front)





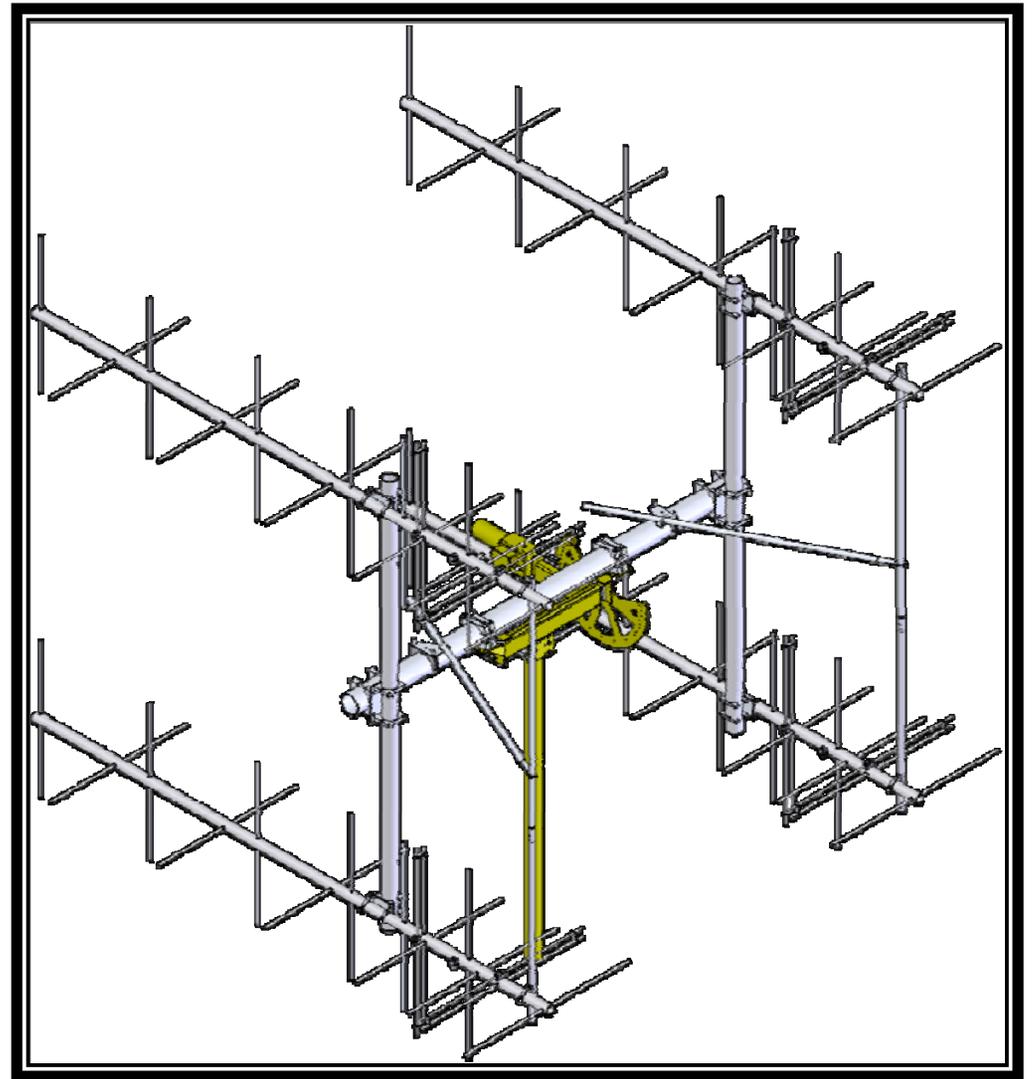
Reconfigured VHF-1/2 Racks at WSGT (GCE room)





Antenna Components

- **Mast and Antenna assembly**
 - **H-Frame and T-Brace assembly**
 - **4 ea, 14 Element YAGI antennas**
 - **4-Port Power divider**
 - **Phased Cabling**
 - **Elevation Rotator**
 - **Mast**





VHF-1 Antenna at ETGT





System Testing

- **Local testing of the VHF-2 system was performed by site personnel on 01/31/12**
 - **VHF-2 system verified operational after removal of the VHF-1 system equipment from the shared racks**
- **Testing of the VHF-1 system was performed 01/31/12 - 02/22/12**
 - **Pre-relocation functional test**
 - **Post installation test (per EC-T0011-01)**
- **Antenna turned yellow on 03/02/12, awaiting International Space Station (ISS) engineering pass prior to turning green**
 - **All support with ISS on hold due to expired VHF-1 frequency license**



System Testing (cont'd)

- **System Acceptance testing was performed by GSFC Sustaining Engineering on 03/06/12 - 03/08/12**
 - **The system was tested as per SCNS-NEN-PRCD-0003 WSC VHF-1 Acceptance Test Procedure**
 - **The RF System (radiating into a dummy load), the Audio System and the Antenna System functioned as expected with the exception of High Power Amplifier (HPA) #2. The power output on this HPA is .5 dB below the minimum specification of 200 watts**
 - **Although the output power is below spec the HPA has enough margin to support Space Station**



Elevation Positioner Failure/Repair

- **During training (03/21/12), noted that when antenna was driven into Hard Limits antenna would continue (slowly) in the same direction but could not be backed out**
- **System has three elevation travel limits**
 - **Soft - Antenna Control Unit (ACU) parameter setting**
 - **Hard - Electrical limit switches**
 - **Physical - Antenna components make contact**
- **Determined that up/down elevation limit switches were wired backwards**
- **During inspection and repair, found that elevation positioner assembly had been damaged from being driven beyond Physical Limits**



Elevation Positioner Failure/Repair (cont'd)

- **Repair required outside contractor to remove and replace positioner assembly**
 - **Vendor on-site 04/03/12 - 04/04/12**
 - **Replaced damaged Elevation Positioner with on-hand spare**
- **Final cable wrap adjustment, ACU to Positioner alignment and antenna motion testing completed by site personnel on 04/05/12**
- **Replacement spare Elevation Positioner was ordered and has been received and placed in stock**



System Re-test

- **Acceptance Testing performed on 05/09/12 - 05/11/12 by a Wallops Subject Matter Expert (SME) and GSFC Sustaining Engineering. All tests were completed successfully with the following exceptions;**
 - **Radiation tests were not performed because transmitting on the VHF-1 frequency is not permitted due to license expiration**
 - **HPA-1 was found to have failed. Post test it was replaced with the spare unit (power output was below spec but usable)**
 - **Note: An engineering unit located at the GSFC bldg 25 test bed was tested and found to be operational. The unit was shipped to WSC on 05/15/12. The unit was installed on 05/17/12 in place of HPA-1**



Discrepancy Reports

Mission Impact (Y/N)	DR#	System/ Subsystem	Problem Description	Operational Workaround	Current Status	Projected Closure Date
N	260573	VHF-1	Low output power from HPA #2 (177W vice 250W)	HPA is usable for VHF-1 communications	Y	06/30/12
Y	260578	VHF-1	Antenna elevation limit switch and drive problem	Antenna was operational for emergency support only	Closed	05/08/12
Y	260698	VHF-1	HPA-1 Failed – very low output power	Replaced with spare from GSFC	Returned to vendor for repair	07/2012



Maintenance

- **Mechanical Preventive Maintenance (PM) will be performed by WSC facilities semi-annually in accordance with the manufacturers specifications**
 - Task will include; checking torque on bolts, oil levels and motor lubrication
- **The WSC Hardware Maintenance Department (HMD) will perform quarterly PM's**
 - PMs will include: Transmit/Receive checks, audio level checks
- **WSC Line Maintenance Technicians (LMT's) will continue to perform the Station Readiness Test (SRT) prior to each scheduled event in accordance with the ISS TNOSP/VHF Annex**
- **Spare Parts**
 - All required Spare Parts are on-hand



Spare Parts

VHF Major Component Spares List			
Description	Model #/Part #	Vendor	Qty. on Hand
Coaxial Switch	LMC224-ANL7X166	Logus Microwave	2
Power Supply (12V@50A)	RM-50	Astron	3
Dual Line Driver Amplifier	142891-13	Miteq	1
Dual DC Controller (ACU)	RC2800 PRK-DC	M2	2
RF High Power Amplifier	PA3-2CG-HMS-SP	TPL	0
Elevation Positioner Motor	MT3000A	M2	1
Azimuth Positioner Motor	OR-2800DC	M2	1
El. Positioner Limit Sw. Kit	LSK3000	M2	4
DUPLEXER VHF1 RF	TBP	ANGLE LINEAR	1
DUPLEXER VHF2 RF	TBP	ANGLE LINEAR	1
TRANSCEIVER, MRT	1600A	MRT	1
Video Camera	F18905W	Foscam	3
RF/RS-232 to Fiber converter **	A03-RS232-D55-AS-S	Optical Zonu	1
Voice Trunking Gateway, 4-Port	VMUX-110/AC/4E&M/ETH/UTP	RAD	1
Voice Trunking Gateway, 8-Port *	VMUX-110/AC/8E&M/ETH-UTP	RAD	1
* VGF-1 & VHF-2 Shared Spare			
** Spare unit is an RF/RS-232 Combined (Both RF and RS-232 active)			



Documentation

Document Title	Status	Published Date
<i>TDRSS Network Operations Support Plan for the International Space Station, 450-TNOSP-ISS</i>	Original Rev1	02/2010 01/10/12
<i>Very High Frequency Voice Communications Support Annex to the TDRSS Network Operations Support Plan for International Space Station, 450-TNOSP-ISS VHF Annex</i>	Original DCN 001	09/2006 02/2009
International Space Station Orbital VOL-I, Program Requirements Document/Program Support Plan/ Operations Requirement/Operations Directive (PRD/PSP/OR/OD)	Active	
ME-19402 Maintenance and Operations (M&O) Manual for the ISS/SOYUZ VHF A/G Communications Systems at WSC and WFF	Original	11/2005
SCNS-VHF-1 SPEC-0001 (Procurement Specification) Very High Frequency One Antenna System with Tower (VHF-1)	Original	07/11/11
Equipment Change (EC)-TO011-1 SCNS-VHF-1 ETGT	N/A	12/14/11
White Sands Complex VHF-1 Acceptance Test Procedure, SCNS-NEN-PRCD-0103	Original DCN 2	05/21/12

Reference Documents	Status	Published Dates
ETN-0306-102B (added 2 single yagi VHF-2 antenna to the VHF-1 quad yagi structure)	N/A	12/1997
SGT-ETN-408 (The tower was reconfigured to support dual quad yagi antennas)	N/A	12/2000
EC-8271 CH01 (reconfiguration back to a quad yagi antenna center configuration with single yagi antennas on each side)	N/A	12/2001
EC-8347 (Upgraded receivers and transmitter to Government Furnished Equipment [GFE] Modular Receiver/Transmitters [MRT])	N/A	04/2004



Documentation (cont'd)

Documentation Requiring Updates	Status	Published Date	Target Release Date
<i>Very High Frequency Voice Communications Support Annex to the TDRSS Network Operations Support Plan for International Space Station, 50-TNOSP-ISS VHF Annex</i>	Revision 1	In Process	07/23/12
ME-19402 Maintenance and Operations (M&O) Manual for the ISS/SOYUZ VHF A/G Communications Systems at WSC and WFF	Original	11/2005	TBD
WSC Local Operating Procedure (LOP) - Volume III Book 13 LOP 02- VHF Pre-Pass Checkout and Computer Configuration	Revision 1	09/2006	07/2012
WSC LOP - Volume III Book 13 LOP 03 - ISS VHF	Revision 1	10/2011	07/2012
WSC LOP - Volume III Book 13 PM 10.301 - VHF Operational Checkout	Revision 6	10/2011	07/2012
WSC LOP - Volume III Book 13 PM 10.500 - VHF SRT	Original	11/2011	07/2012



Requirements Test Matrix

<p style="text-align: center;">WSC VHF-1 Requirements Test Matrix</p> <p style="text-align: center;">Green - Successfully Completed Yellow - Partially Successful Red - Failed Black - Not Applicable White - To Be Tested</p>	Installation Testing as per EC-TO011-01	Acceptance Testing per SCNS-NEN-Plan-0103	Station Readiness Test per TNOSP VHF Annex	Engineering Pass	Current Status
	U/L Requirements				
Uplink @ VHF-1 Frequency (139.208 MHz)					
Uplink @ VHF-2 Frequency (130.167 MHz)					
D/L Requirements					
Downlink @ VHF-1 Frequency (143.625 MHz)					
Downlink @ VHF-2 Frequency (121.750 MHz)					
Tracking Requirements – VHF-1					
Load and Process TLE – VHF-1					
Drive Antenna through Predicted Path – VHF-1					



Remaining Work

- **Repair/replace HPAs with low output**
- **Fabricate, test and install solution to remotely switch U/L and D/L RF between System 1 and System 2 from GCE room**
- **Fabricate, test and install solution to remotely key transmitter from GCE room**
- **Establish ability to separately record U/L and D/L audio on MOVE**
- **Video camera will be installed under VHF-2 effort**
- **Perform RF Pattern Testing**
- **Perform masking survey**
- **Publish updated procedures (see Documentation Requiring Updates)**
 - **An Alert Notice is currently in place detailing system setup and operation**



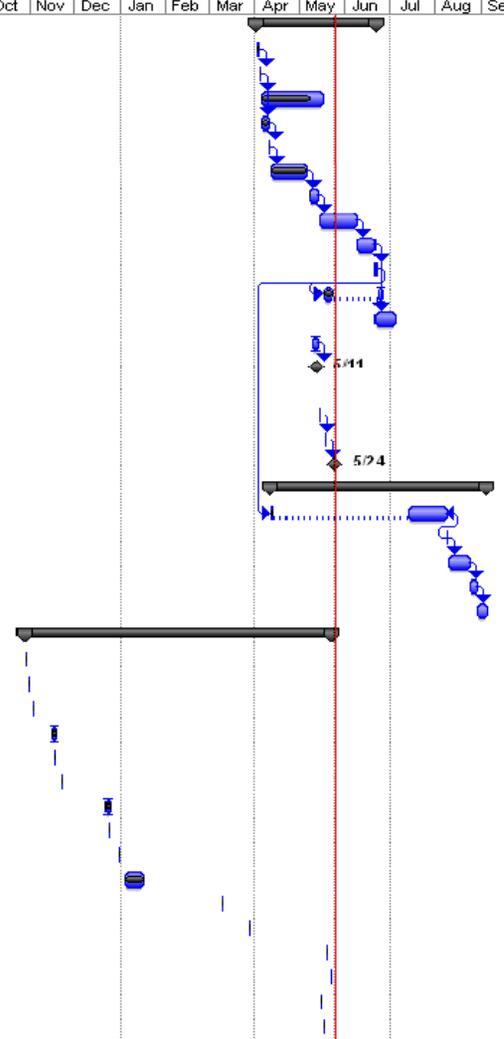
Project Schedule

ID	Task Name	Start	Finish	% Complete	Qtr 3, 2011			Qtr 4, 2011			Qtr 1, 2012			Qtr 2, 2012			Qtr 3, 2012		
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	TO-11 WSC VHF-1 Antenna Upgrade	Mon 7/11/11	Mon 9/3/12	83%															
2	VHF-1 Antenna Installation	Mon 7/11/11	Tue 7/3/12	89%															
3	Procure Antenna and Mast Install Services	Mon 7/11/11	Tue 1/3/12	100%															
4	Solicit Install Bids	Mon 7/11/11	Wed 9/28/11	100%															
5	Draft SOW	Mon 7/11/11	Wed 8/24/11	100%															
6	Submit SCW for final Approval	Thu 8/25/11	Mon 8/29/11	100%															
7	Solicit Bids	Tue 8/30/11	Wed 9/28/11	100%															
8	Review Bids & Select Vendor	Thu 9/29/11	Fri 9/30/11	100%															
9	Complete contract with selected vendor	Tue 12/6/11	Fri 12/16/11	100%															
10	Procure Antenna, Mast and Tower Materials	Mon 8/29/11	Tue 1/3/12	100%															
11	Submit MSRs for hardware	Mon 8/29/11	Wed 8/31/11	100%															
12	Complete contract with M^2	Thu 9/1/11	Wed 10/5/11	100%															
13	M2 perform IRF work	Thu 10/6/11	Mon 11/14/11	100%															
14	Perform NRE	Thu 10/6/11	Mon 11/14/11	100%															
15	Part certified or waived	Mon 11/14/11	Mon 11/14/11	100%															
16	M2 procure 30 foot tower	Tue 11/15/11	Tue 1/3/12	100%															
17	Tower Vendor fabricate custom antenna plates	Tue 11/15/11	Mon 12/26/11	100%															
18	Tower Vendor fabricate tower	Tue 11/15/11	Mon 12/26/11	100%															
19	Tower delivered and inspected	Tue 12/27/11	Tue 1/3/12	100%															
20	M^2 fabricate/assemble Remaining HW items	Thu 10/6/11	Tue 11/22/11	100%															
21	Hardware delivered and inspected	Wed 11/23/11	Thu 12/1/11	100%															
22	VHF-1Relocation	Thu 9/8/11	Mon 6/25/12	85%															
23	Develop EC-T0011-1	Thu 9/8/11	Thu 12/15/11	100%															
24	CRB	Wed 12/14/11	Wed 12/14/11	100%															
25	Procure relocation hardware	Tue 12/6/11	Fri 2/3/12	100%															
26	Prep ETGT for new Equipment	Mon 1/16/12	Fri 1/27/12	100%															
27	Coordinate station downtime with JSC	Thu 12/15/11	Mon 12/19/11	100%															
28	Schedule Equipment relocation/test w/ SN Scheduling	Mon 1/30/12	Mon 1/30/12	100%															
29	Mast and Antenna Installation	Mon 1/30/12	Fri 1/27/12	100%															
30	WSC Perform pre-mod check out	Mon 1/30/12	Mon 1/30/12	100%															
31	Status System Red	Tue 1/31/12	Thu 2/9/12	100%															
32	Relocate Equipment	Tue 1/31/12	Tue 1/31/12	100%															
33	VHF-2 loop test	Tue 1/31/12	Tue 1/31/12	100%															
34	Interface Antenna/Equipment	Wed 2/1/12	Wed 2/29/12	100%															
35	Local System Test	Thu 3/1/12	Fri 3/2/12	100%															
36	GSFC perform local Engineering test per test plan	Tue 3/6/12	Thu 3/8/12	100%															
37	JSC Eng Test - Set voice levels	Mon 3/19/12	Mon 3/19/12	100%															



Project Schedule (cont'd)

ID	Task Name	Start	Finish	% Complete	Qtr 3, 2011			Qtr 4, 2011			Qtr 1, 2012			Qtr 2, 2012			Qtr 3, 2012		
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
38	Remote Keying/Switching	Mon 4/2/12	Thu 6/21/12	54%															
39	High Level Design	Mon 4/2/12	Tue 4/3/12	100%															
40	Submit MSRs	Wed 4/4/12	Wed 4/4/12	100%															
41	Receive Parts	Thu 4/5/12	Wed 5/16/12	75%															
42	Draft Block Diagram	Thu 4/5/12	Mon 4/9/12	100%															
43	mini-PLR	Tue 4/10/12	Tue 4/10/12	100%															
44	Create Assembly/Cable Drawings	Wed 4/11/12	Fri 5/4/12	100%															
45	Assemble Cables and Components	Mon 5/7/12	Fri 5/11/12	25%															
46	Short Loop Component Testing	Mon 5/14/12	Thu 6/7/12	0%															
47	Long Loop Testing	Fri 5/8/12	Tue 5/15/12	0%															
48	Update EC	Wed 6/20/12	Thu 6/21/12	0%															
49	EC-T0011-1 Closeout	Thu 5/17/12	Mon 6/25/12	79%															
50	Update HMD LOPs w/ Remote Keying/Switching Details	Wed 6/20/12	Tue 7/3/12	0%															
51	WGS Engineering per formal local Engineering test per test plan	Wed 5/9/12	Fri 5/11/12	0%															
52	Status system yellow	Fri 5/11/12	Fri 5/11/12	0%															
53	Obtain VIIF Freq Authorization	Fri 5/25/12	Fri 5/25/12	0%															
54	Request JSC engineering pass	Mon 5/14/12	Mon 5/14/12	0%															
55	Perform engineering pass with JSC	Fri 5/18/12	Fri 5/18/12	0%															
56	Ops Readiness Review	Thu 5/24/12	Thu 5/24/12	0%															
57	VHF-2 Reconfiguration/As-Built Documentation	Wed 4/11/12	Mon 9/3/12	5%															
58	Develop EC-T0011-2	Wed 4/11/12	Wed 8/8/12	10%															
59	CRR	Wed 8/8/12	Wed 8/8/12	0%															
60	Implementation Activities	Thu 8/9/12	Wed 8/22/12	0%															
61	Local System Test	Thu 8/23/12	Mon 8/27/12	0%															
62	EC-T0011-2 Closeout	Tue 8/28/12	Mon 9/3/12	0%															
63	Soyuz Missions	Fri 10/28/11	Tue 5/22/12	96%															
64	SOYUZ-42P Undock Freeze	Fri 10/28/11	Fri 10/28/11	100%															
65	SOYUZ/ISS-45P launch	Sun 10/30/11	Sun 10/30/11	100%															
66	SOYUZ/ISS-45P Dock Freeze	Wed 11/2/11	Wed 11/2/11	100%															
67	SOYUZ-28S Launch	Mon 11/14/11	Wed 11/16/11	100%															
68	SOYUZ/ISS-28S Dock Freeze	Wed 11/16/11	Wed 11/16/11	100%															
69	SOYUZ-27 Undock	Tue 11/22/11	Tue 11/22/11	100%															
70	SOYUZ-29S Launch	Wed 12/21/11	Fri 12/23/11	100%															
71	SOYUZ/ISS-29S Dock Freeze	Fri 12/23/11	Fri 12/23/11	100%															
72	JSC SAW Transition - heightened awareness	Fri 12/30/11	Fri 12/30/11	100%															
73	JSC SAW Transition - heightened awareness	Tue 1/3/12	Sat 1/14/12	100%															
74	ATV-3 Launch	Fri 3/9/12	Fri 3/9/12	100%															
75	ATV-3 Docking	Wed 3/28/12	Wed 3/28/12	100%															
76	Space-X Launch	Sat 5/19/12	Sat 5/19/12	100%															
77	Space-X Docking	Tue 5/22/12	Tue 5/22/12	0%															
78	SOYUZ-30 Launch	Tue 5/15/12	Tue 5/15/12	100%															
79	SOYUZ-30 Docking	Thu 5/17/12	Thu 5/17/12	100%															

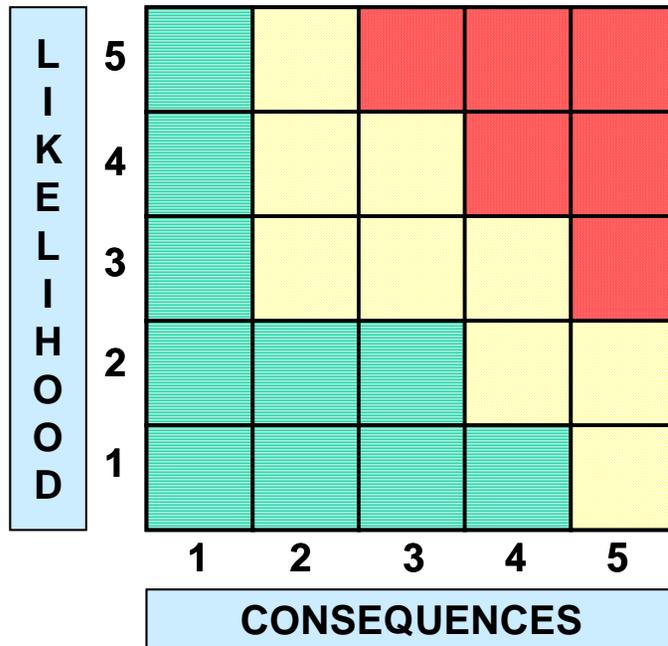




Risks



Risks



LxC Trend	Rank	Approach	Risk Title
			There are no risks at this time

Criticality	L x C Trend	Approach
High	↓ Decreasing (Improving)	M – Mitigate
Med	↑ Increasing (Worsening)	W – Watch
Low	➡ Unchanged	A – Accept
	* New since last mission	R – Research



Risks

There are no risks at this time

Rank	Risk Statement	Approach & Plan	Comments

Risk Criticality   



Summary

- **The Flight Dynamics Facility (FDF) database has been updated to reflect the new VHF-1 antenna identification and location coordinates**
- **The WSC VHF-1 system has been upgraded and thoroughly tested against design specifications**
- **The system is currently “yellow” and will be turned “green” upon completion of a successful ISS certification pass**
- **The VHF-1 Frequency License renewal was approved on 05/17/12. An engineering pass has been requested**
- **All personnel have been trained**

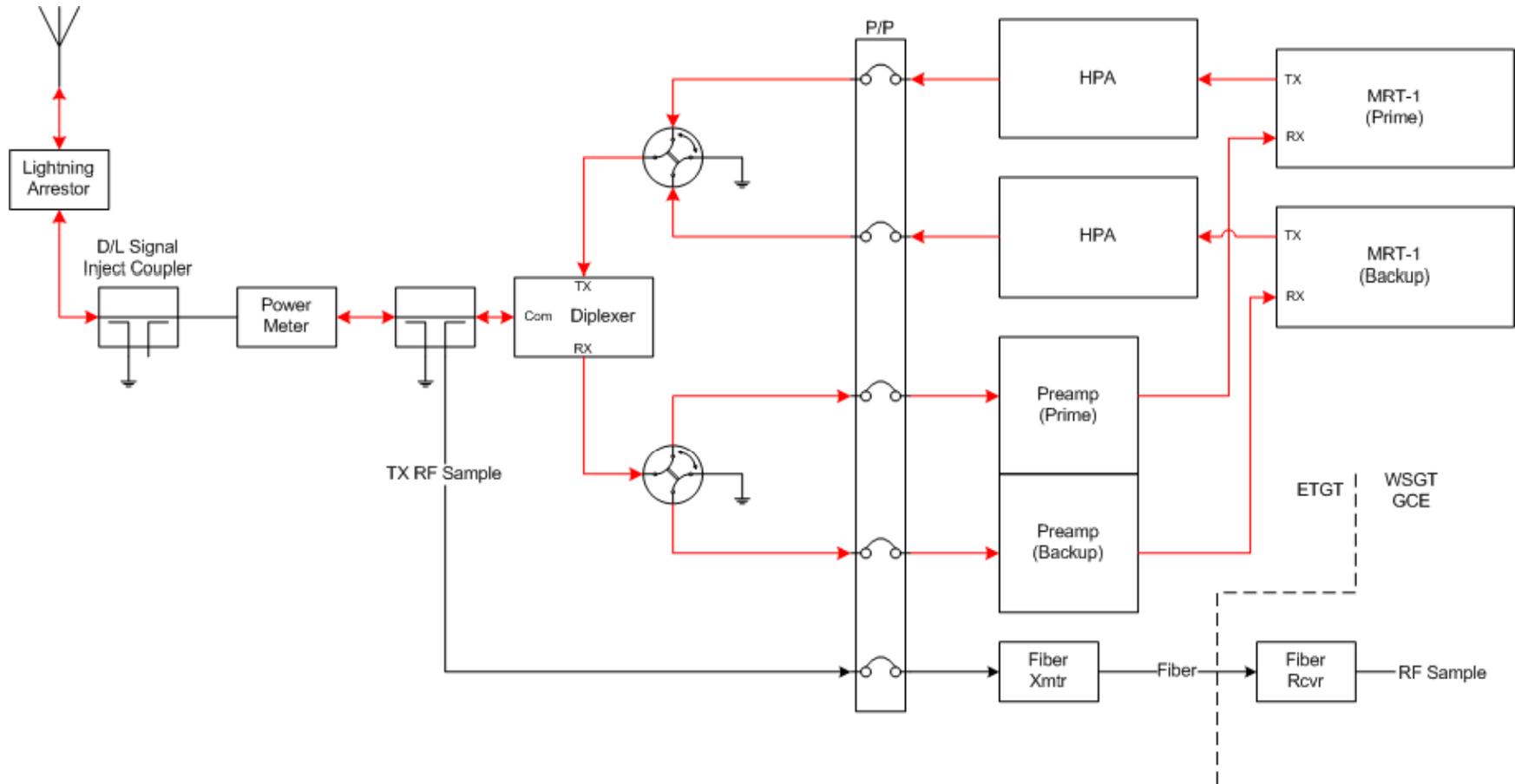
**The system is ready for support pending an
ISS certification pass**



Backup

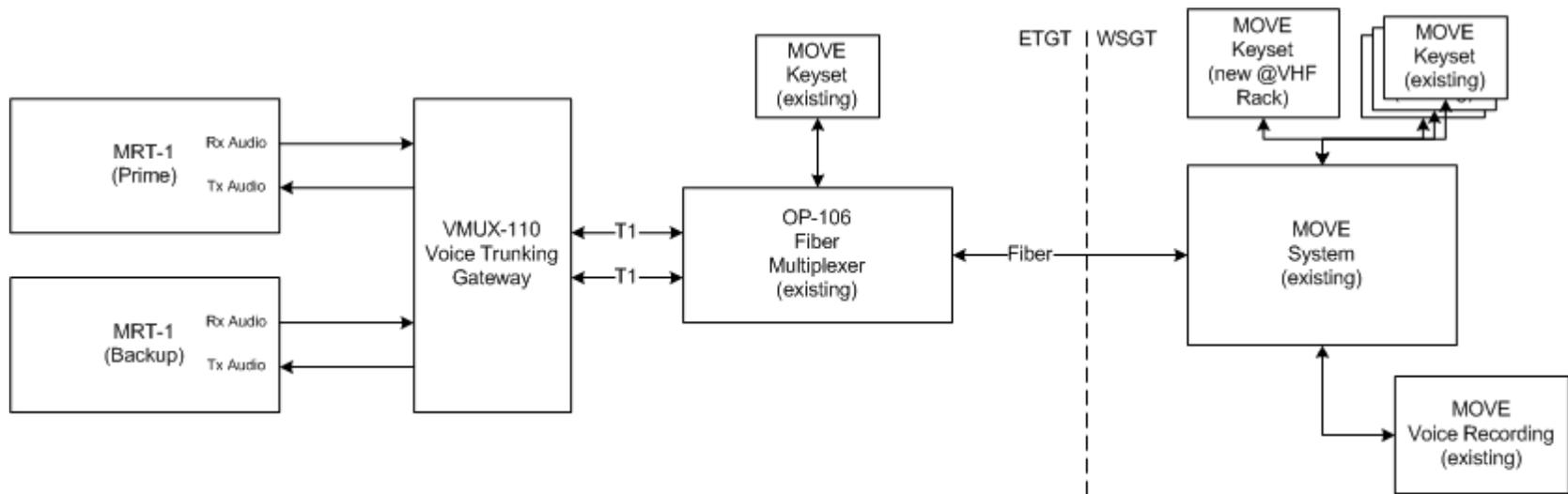


VHF-1 RF Signal Flow



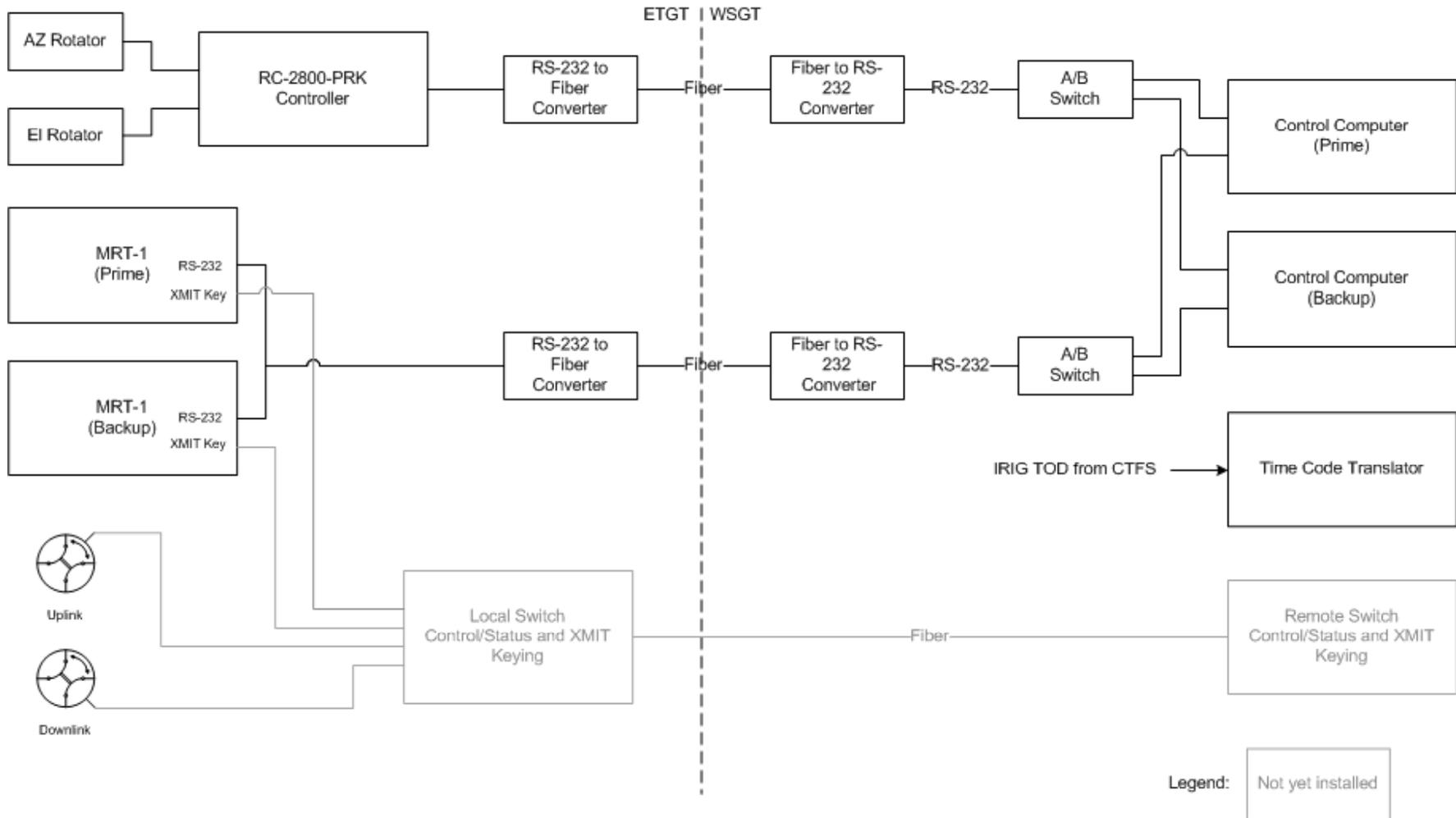


VHF-1 Audio Signal Flow





VHF-1 Control and Status





CoFR Signature Sheet



*Exploration and Space Communications
Projects Division*



Certificate of Flight Projects Directorate Networks Readiness

This is to certify that with successful completion of flight readiness preparations and closure of associated action items, all integrated network elements are ready to support the WSC VHF-1 Upgrade ORR

Michael Yettaw,
DFRC, Range Technical Monitor, WATR

Date



Acronym List



Acronym List

DR	Discrepancy Reports	RF	Radio Frequency
EC	Equipment Change	SOW	Statement of Work
ETGT	Extended TDRS Ground Terminal	VHF	Very High Frequency
FCC	Federal Communications Commission	WSC	White Sands Complex
FDF	Flight Dynamics Facility	WSGT	White Sands Ground Terminal
GCE	Ground Control Equipment		
GFE	Government Furnished Equipment		
GNSTAT	Ground Network Status		
GSFC	Goddard Space Flight Center		
HMD	Hardware Maintenance Department		
HPA	High Power Amplifier		
JSC	Johnson Space Center		
LOP	Local Operating Procedure		
M&O	Maintenance and Operations		
MIR	Russian Space Station Mir		
MOVE	Mission Operations Voice Enhancement		
MRT	Modular Receiver/Transmitters		
MSR	Material Service Request		
ORR	Operational Readiness Review		
PA	Power Amplifier		
PM	Preventive Maintenance		